equipment needs of the total market. Such uses as training simulators, graphics, and broadcasting can be expected eventually to be in large demand for HDTV equipment, especially if the one-world standard is achieved. The filmmaking community, however, will benefit from the economies of scale thus created to avail itself of high-quality equipment at reasonable cost. It is also possible that modifications, if necessary, to conform to special needs of the filmmaker, such as 48 fields/sec or progressive scan, could be incorporated into this equipment to suit particular applications of filmmakers. The high-resolution monitors presently available with agile raster scan rates, are hopefully a sample of the future in this regard.

Distribution

In the field of distribution, HDTV could eventually add dimensions to the market for film studio products which are not available today. The large-screen experience of quality images in the home or minitheaters will generate interest, hold attention, and create greater demand. Those who doubt that quality creates demand need only look at the burgeoning hi-fi business and, more recently, the compact disc. Commonality of equipment resulting from a single HDTV standard could lower equipment costs, making it affordable to more people. Program producers will stand to benefit from this larger viewer audience.

In the case of the electronic cinema, the lure of distribution by satellite has been a dream of motion-picture distributors for years. It will eliminate need for costly prints. Mechanical projection needing close attendance by a projectionist will become obsolete. Furthermore, distribution could permit tripling or quadrupling the number of theaters showing the product at any one time, thereby permitting rapid payback of the investment in a picture. That picture, quickly played out in first-run theatrical release, will accelerate the cycle of distribution to the ancillary markets to further enhance payback.

For electronic cinema release, many believe that a transmission standard other than that used for broadcast would be desirable. This would discourage unauthorized duplication, which is a matter of great concern to motion-picture producers, in a world where authorities tell us that over $1 billion a year is lost to pirates.

To equip the electronic cinema, a large-screen projector needs to be perfected. One approach to this is the laser projector, which is being developed in several laboratories. More work needs to be done to improve color rendition, eliminate speckle, and reduce the high cost, before lasers will be acceptable replacements for the film projector. Cathode-ray projection for really large screens appear to be complex. Neither of these projectors requires projectionists to thread film and operate it, but they will need precision setup and maintenance by qualified personnel to assure the peak performance demanded of truly high-definition performance.

Even though progress is made every year in these techniques, the electronic cinema remains in the future for some years to come. The minitheaters we see springing up in many places, equipped with better-than-home-quality equipment, will add marketing opportunity, but they never will replace the large screens and quality presentation to be experienced at a well-appointed and operated theater.

In distributing feature films and "made for TV" drama to the ancillary markets today, film reigns supreme. Even though the networks are accepting videotape, we find that customers in the domestic market prefer programs on film. The smaller stations prefer 16mm because they lack the videotape equipment. Film offers these stations the convenience of splicing a whole evening's programming together on several reels, integrating commercials and station breaks, and letting it roll.

Foreign Markets

In foreign distribution, the most quality-conscious countries, such as Germany and Great Britain, demand 35mm prints from which they make their own telecine transfers to the TV standard of the country. In this way, they can achieve the "look" most desired — and that is by no means uniform among various countries. Our Japanese customer, the Fuji Network, also prefers film rather than videotape. In international syndication at Universal, the proportion of videotape shipped in 1985 was 6% of the total activity.

Looking ahead to the world distribution if a one-world HDTV standard can be established, we will no longer be called upon separately to master videotape for each of the present-day standards. This in itself is of major economic value to producers. Pressure on vault space will ease because it would no longer be necessary to store masters for NTSC, PAL, and SECAM in 1-in. B or C format, 2-in. quad, or segmented scan. Eventually one master would prevail.

Programs traveling between countries will be transcoded on converters which not only produce pictures better than original live TV pickup in each country's format, but which also will give customers the ability to fine-tune color and gamma in a manner similar to the range of control of today's telecines. The wide-screen aspect ratio recorded on HDTV tape could be conformed to the 4:3 aspect ratio through pan-scan information recorded onto the HDTV tape control track by the producer in the post-production house.

This rosy picture depends upon getting the common standard from the CCIR. If that does not happen, HDTV would become just one more standard to service with yet another videotape format.

Increased Speed and Frame Rate

If our wish is realized and the 30 sec/frame HDTV standard comes into being, it would be an excellent occasion to fully examine the tradeoffs of shifting film to 30 frames/sec. This practice is now widespread in film shot for commercials and music videos where transfer to television is the only outlet. There are well known advantages in cinema projection to be gained from the increased speed and frame rate. Certainly brighter projected images with less flicker will result. Thirty-frame/sec film was previously used for the 70mm version of *South Pacific*. Sound would benefit also from higher speed of 30 frame/sec film, and perhaps this, coupled with film's resolving power, could bring photographic digital sound track into the realm of possibility.

Acknowledgment

I would like to acknowledge the help and support of studio general manager Dan Slusser and Jim Watters, vice-president, post-production, for their encouragement in this work. Also thanks to my colleagues on the SMPTE WGHDEP who have helped make this past year and a half a most rewarding experience.

EXHIBIT 2

NHK	NTSC
1125 lines	525 lines
60 fields/second	60 fields/second
2:1 interlace	2:1 interlace
16:9 (5.33:3)	4:3 aspect ratio

EXHIBIT 3

COMPARISON OF HDTV TO NTSC

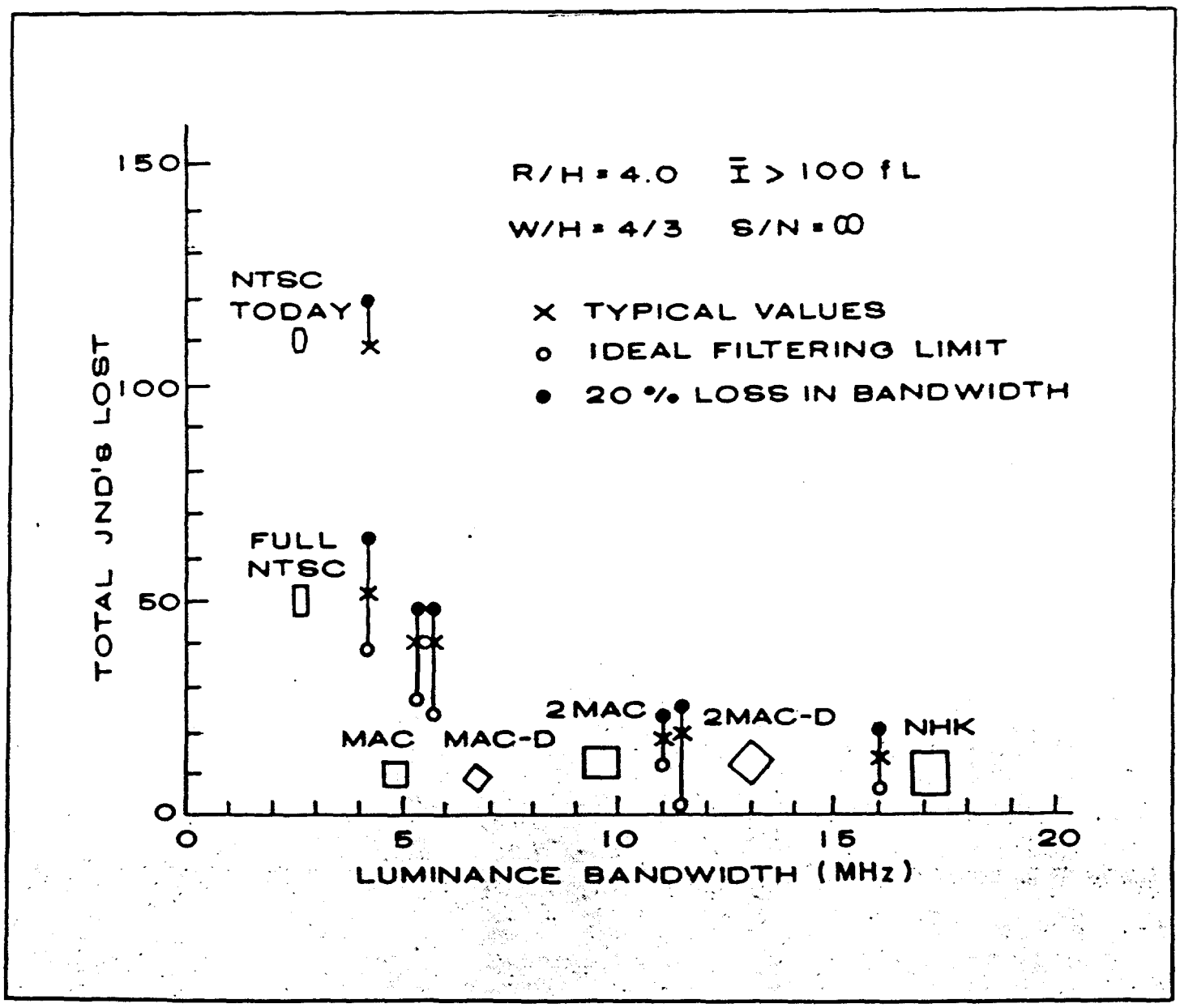

Figure 1. Plot of the total number of JNDs of signal lost when compared to a perfect image as a function of transmitted luminance bandwidth. All systems have 30-Hz frame rates and are viewed from 4 ph. The small figure beneath the name of each system gives a rough indication of the spatial frequency shape of that system. Note that the general results of this figure are maintained over reasonable assumptions about the quality of the filtering used. The points marked *X* represent the values from Table 1.

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EXHIBIT 4

On January 7, 1987, the NAB/MST opened their demonstration of over-the-air HDTV transmissions at the NAB headquarters and FCC offices in Washington, D.C. The intent of the demonstration was two-fold:

1. Show the FCC that HDTV is a reality and that additional spectrum is needed by the broacasters if they are to broadcast HDTV.
2. Demonstrate publicly that HDTV is imminent and prove that it is deliverable by over-the-air transmission.

The transmission format used was a bandwidth reduction technique called MUSE, designed for the NHK HDTV system. The audience viewed the HDTV picture on a number of direct view HDTV television sets, a large screen projection television system and an NTSC picture converted from MUSE. The HDTV pictures looked sensational but contained transmission processing induced flaws.

The Japanese influence was pervasive, with all the equipment Japanese and the Japanese technicians and engineers far outnumbering the viewers. The MST has stated this demonstration was not designed to advocate a particular system but to demonstrate the reality of HDTV. Other systems will be demonstrated at an undetermined date.